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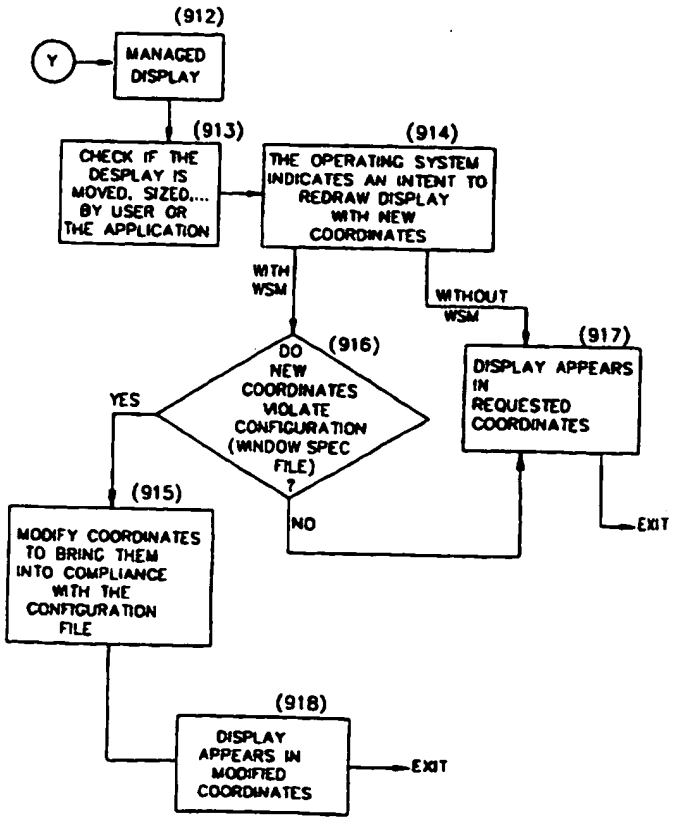
(54) Title: METHOD FOR CONSTRAINING THE AVAILABLE DISPLAY SURFACE IN WHICH APPLICATION DISPLAYS MAY BE RENDERED

(57) Abstract

A method for constraining the available display surface in which an application display is displayed includes a display surface being divided into a predetermined number of windows. Each window is defined to have a unique area of the display surface and is assigned to a predetermined category of display. The method comprises the steps of modifying an application display in response to an input to modify the display. The modified display is verified to assure that the modified application display complies with specified parameters contained in a configuration file. The configuration file includes sizes and position parameters. If the modified application display does not comply with the specified parameters, the modified application display is changed to conform with the parameters of the configuration file and outputted for display.



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METHOD FOR CONSTRAINING THE AVAILABLE DISPLAY SURFACE IN WHICH APPLICATION DISPLAYS MAY BE RENDERED

RELATED APPLICATIONS

The present application is related to the following:

1. Patent application, Serial No. _____, entitled "Method for Configuring and Controlling Computer Windows' Display of Multiple Applications";
2. Patent application, Serial No. _____, entitled "Method of display categorization in a Multi-Window Display Environment";
3. Patent application, Serial No. _____, entitled "Method for Re-Invoking Previously Displayed Software Application Displays in a Multi-Window Environment";
4. Patent application, Serial No. _____, entitled "Method for Constraining the Number of Displays in a Multi-Window Computer Environment";
5. Patent application, Serial No. _____, entitled "Method for Configuring the Display Properties to be Applied to Predetermined Application Displays"; and
6. Patent application, Serial No. _____, entitled "Method for Controlling the Presentation of Displays in a Multi-Window Computer Environment";

all of the above being incorporated by reference herein, and all of the above filed on even date herewith, and all of the above assigned to Honeywell Inc., the assignee of the present application.

METHOD FOR CONSTRAINING THE AVAILABLE DISPLAY SURFACE IN WHICH APPLICATION DISPLAYS MAY BE RENDERED

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region. A display can be easily enlarged (via standard maximize button) and yet not necessarily consume the entire display surface available to the computer. Displays can be protected from inadvertent occlusion by other displays; namely, the present invention provides the ability to retain a high level of confidence that critical displays are not rendered inaccessible because they cannot be found under a clutter of non-critical displays.

SUMMARY OF THE INVENTION

Therefore, there is provided by the present invention a method for constraining the available display surface in which applications are rendered in a multi-window environment. The method in which an application display is displayed includes a display surface divided into a predetermined number of windows. Each window is defined to have a unique area of the display surface and is assigned to a predetermined category of display. The method comprises the steps of modifying an application display in response to an input to modify the display. The modified application display is verified to assure that the modified application display complies with specified parameters contained in a configuration file. The configuration file includes parameters which include, but are not limited to, size and position parameters. If the modified application display does not comply with the specified parameters of the configuration file, the application display is changed to conform with the parameters of the configuration file and the application file is outputted. If the modified application display complies with the specified parameters of the configuration file, the modified application display is outputted.

Accordingly, it is an object of the present invention to provide a method for constraining the available display surface in which applications are rendered in a multi-window environment.

It is another object of the present invention to provide a method for constraining the available display surface by partitioning in a predetermined manner the geographic

area of a display surface such that not all applications can consume the entire available display area.

These and other objects of the present invention will become more apparent when taken in conjunction with the following description and attached drawings, wherein like characters indicate like parts, and which drawings form a part of the present application.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows a block diagram of a process control system of the preferred embodiment in which the present invention can be utilized;

Figure 2 shows a block diagram of common elements of each physical module of the process control system of Figure 1;

Figure 3 shows a functional block diagram of a typical physical module of the process control system;

Figure 4 shows a block diagram of a Workspace Manager Display System of the preferred embodiment;

Figure 5 shows the layout of an example configuration of a display of the Workspace Manager System (WSM), each window representing a different set of configured display characteristics, including but not limited to, the shown window locations and sizes;

Figure 6 shows an example ordering by which a newly-invoked application display area is related to a specific set of display characteristics for the example of Figure 5;

Figure 7, which comprises Figures 7A and 7B, shows a flow diagram of the WSM software operating in the Workspace Manager Display System in which the method of the present invention is utilized;

Figure 8 shows an example workspace having one (1) critical display and four (4) non-critical displays;

Figure 9 shows an example of a maximized non-critical display and the remaining critical display of the configuration of Figure 8;

Figure 10 shows the coordinate system identified with the display surface of the preferred embodiment of the present invention; and

Figure 11 shows a display surface having one window dragged to the middle of the display surface and one window display specified as "always on top".

DETAILED DESCRIPTION

Before describing the method of the present invention, it will be helpful in understanding a system environment in which the invention is utilized. Referring to Figure 1, there is shown a block diagram of a process control system 10 of the preferred embodiment in which the present invention can be found. The process control system 10 includes a plant control network 11, and connected thereto is a data hiway 12, which permits a process controller 20' to be connected thereto. In the present day process control system 10, additional process controllers 20' can be operatively connected to the plant control network 11 via a corresponding hiway gateway 601 and a corresponding data hiway 12. A process controller 20, an interface apparatus which includes many new additions, improvements, and features over the process controller 20', is operatively connected to the plant control network 11 via a universal control network (UCN) 14 to a network interface module (NIM) 602. In the preferred embodiment of the process control system 10 additional process controllers 20 can be operatively connected to the plant control network 11 via a corresponding UCN 14 and a corresponding NIM 602. The

process controllers 20, 20' interface the analog input and output signals and digital input and output signals (A/I, A/O, D/I, and D/O respectively) to the process control system 10 from the variety of field devices (not shown) of the process being controlled which include valves, pressure switches, pressure gauges, thermocouples. . . . .

The plant control network (or more simply network) 11 provides the overall supervision of the controlled process in conjunction with the plant operator and obtains all the information needed to perform the supervisory function and includes an interface with the operator. The plant control network 11 includes a plurality of physical modules (or nodes), which include a universal operator station (US) 122, an application module (AM) 124, a history module (HM) 126, a computer module (CM) 128, and duplicates (backup or secondary) of these modules (and additional types of modules, not shown) as necessary to perform the required control/supervisory function of the process being controlled. Each of these physical modules is operatively connected to a local control network (LCN) 120, which permits each of these modules to communicate with each other as necessary. The NIM 602 and HG 601 provide an interface between the LCN 120 and the UCN 14 and the LCN 120 and the data hiway 12, respectively.

Physical modules 122, 124, 126, 128, . . . of network 11 of the preferred embodiment are of various specialized functional types. Each physical module is the peer, or equivalent, of the other in terms of right of access to the network's communication medium, or LCN 120, for the purpose of transmitting data to other physical modules of network 11.

Universal operator station module (US) 122 of network 11 is a workstation for one or more plant operators.

A history module (HM) 126 provides mass data storage capability. The history module 126 includes at least one conventional disk mass storage device, such as a Winchester disk, which disk storage device provides a large volume of nonvolatile storage capability for binary data. The types of data stored by such a mass storage device are typically trend histories, event histories, ...or data from which such histories can be

determined, data that constitutes or forms CRT type displays, copies of programs for the physical modules . . . .

An application module (AM) 124 provides additional data processing capability in support of the process control functions performed by the controllers associated with the process control subsystem 20, 20' such as data acquisition, alarming, batch history collection, and provide continuous control computational facilities when needed. The data processing capability of the application module 124 is provided by a processor (not shown) and a memory (not shown) associated with the module.

Computer module (CM) 128 uses the standard or common units of all physical modules to permit a medium-to-large scale, general purpose data processing system to communicate with other physical modules of network 11 and the units of such modules over the LCN 120 and the units of process control subsystems 20, 20' via the hiway gateway module 601, and the NIM 602, respectively. Data processing systems of a computer module 128 are used to provide supervisory, optimization, generalized user program preparation, and execution of such programs in higher-level program languages. Typically, the data processing systems of a computer module 128 have the capability of communicating with other such systems by a communication processor and communication lines.

The local control network 120 (LCN) is a high-speed, bit serial, dual redundant communication network that interconnects all the physical modules of plant control network 11. LCN 120 provides the only data transfer path between the principal sources of data, such as hiway gateway module 601, application module 124, and history module 126, and principal users of such data, such as universal operator station module 122, computer module 128, and application module 124. LCN 120 also provides the communication medium over which large blocks of data, such as memory images, can be moved from one physical module, such as history module 126, to universal station module 122. LCN 120 is dual redundant in that it consists of two coaxial cables that permit the serial transmission of binary signals over both cables.

Referring to Figure 2, there is shown a block diagram of the common elements of each physical module of the network 11 or the process control system 10. Each of the physical modules includes a module central processor unit 38 and a module memory 40, a random-access memory (not shown), and such additional controller devices, or units (not shown), which are configured to provide the desired functionality of that type of module, i.e., that of the operator station 122, for example. The data-processing capabilities of each module's CPU 38 and module memory 40 create a distributed processing environment which provides for improved reliability and performance of network 11 and process control system 10. The reliability of network 11 and system 10 is improved because, if one physical module of network 11 fails, the other physical modules will remain operational. As a result, network 11 as a whole is not disabled by such an occurrence as would be the case in centralized systems. Performance is improved by this distributed environment in that throughput and fast operator response times result from the increase computer processing resources and the concurrency and parallelism of the data-processing capabilities of the system.

As mentioned above, each physical module includes the BUS interface unit (BIU) 32, which is connected to the LCN 120 by the transceiver 34. Each physical module is also provided with the module BUS 36 which, in the preferred embodiment, is capable of transmitting 16 bits of data in parallel between the module CPU 38 and the module memory 40. Other units, utilized to tailor each type of physical module to satisfy its functional requirements, are operatively connected to module BUS 36 so that each such unit can communicate with the other units of the physical module via its module BUS 36. The BIU 32 of the physical module initiates the transmission of data over LCN 120. In the preferred embodiment, all transmissions by a BIU 32 are transmitted over the coaxial cables which, in the preferred embodiment, form the LCN 120.

Referring to Figure 3 there is shown a functional block diagram of a typical physical module 122, 124, 126, 128 of the plant control network 11, and includes the BUS 32 and the transceiver 34, which connects BIU 32 to the LCN 120. BIU 32 is capable of transmitting binary data over LCN 120 and of receiving data from LCN 120. Transceiver 34, in the preferred embodiment, is transformer coupled to the LCN 120. In the preferred

embodiment, the LCN 120 is a dually-redundant coaxial cable with the capability of transmitting bit serial data. BIU 32 is provided with a very fast micro-engine 56. In the preferred embodiment, micro engine 56 is made up of bit slice components so that it can process eight bits in parallel and can execute a 24 bit microinstruction from its programmable read only memory (PROM) 58.

Signals received from the LCN 120 are transmitted by transceiver 34 and receive circuitry 52 to receive FIFO register 54. Micro engine 56 examines the data stored in FIFO register 54 and determines if the information is addressed to the physical module. If the data is an information frame, the received data is transferred by direct memory access (DMA) write circuitry 66 by conventional direct memory access techniques to the physical module memory unit (MMU) 40 over module BUS 36.

Communication between MCPU processor 68, a Motorola 68020 microprocessor in the preferred embodiment, and other functional elements of MCPU 38 is via local microprocessor BUS 39. Module BUS interface element 41 provides the communication link between local BUS 39 and module BUS 36. Processor 68 executes instructions fetched from either its local memory 43, in the preferred embodiment an EPROM, or from MMU 40. Processor 68 has a crystal controlled clock 45 which produces clock pulses, or timing signals. Input/output (I/O) port 49 provides communication between MCPU 38 and equipment external to the physical module to permit program loading and the diagnosis of errors, or faults, for example.

Each MCPU 38 includes a timing subsystem 48 which, in response to clock signals from module clock 45, produces fine resolution, synchronization, and real-time, timing signals. Any timing subsystem 48, which is provided with a timing subsystem driver 50, has the capability of transmitting timing information to other physical modules over the LCN 120. Another input to each timing subsystem 48 is timing information which is transmitted over LCN 120 and which is received through transceiver 34, timing receiver 55, and timing driver 57 of BIU 32. Timing pulses from module power supply 59, which are a function of the frequency of the external source of A.C. electric power

applied to power supply 59, are used by timing subsystem 48 to correct longer-term frequency drift of the clock pulses produced by clock 45.

Additional information of the BIU 32 can be found in U.S. Patent No. 4,556,974. A more detailed description of the process control system 10 can be had by referring to U.S. Patent No. 4,607,256. Additional information of the individual, common, functional blocks of the physical modules can be had by reference to U.S. Patent No. 4,709,347, all of the above-identified patents being assigned to the assignee of the present application; and additional information of the process controller 20' can be had by referencing U.S. Patent No. 4,296,464.

The addition of an interface apparatus which interfaces other systems to the process control system 10 described above and a modification to a graphics generator in the US 122 opens up the existing system, specifically the graphics interface, which includes designing-in the capability to readily permit nodes of differing designs to communicate to the network. In order to open up the graphics interface such that a display which is not on the LCN can be displayed onto the CRT 151 of the US 122, there is included an interface to a graphics card of the US 122 from a co-processor. For more detailed information regarding the opening of the graphics interface, reference can be made to U.S. Patent No. 5,386,503, entitled "Method for Controlling Window Displays in an Open Systems Windows Environment," and to U.S. patent No. 5,530,844, entitled "Method of Coupling Open Systems to a Proprietary Network," both patents being assigned to the same assignee of the present application.

The display system which incorporates the method of the present invention will now be described. Referring to Figure 4, there is shown a block diagram of a Workspace Manager (WSM) Display System of the preferred embodiment of the present invention. The Workspace Manager Display System, or more simply referred to as Workspace Manager 124, is coupled to the LCN 120 of the process control system 10 in the preferred embodiment. The Workspace Manager (WSM) 124 is a personal computer (PC) which can be purchased in the marketplace, and includes an LCN co-processor 127 coupled to the LCN 120 and to an internal BUS (PCBUS) 131 of the PC (i.e., of the WSM 124). The

LCN co-processor 127 includes the BIU 32, the module BUS 36, the module CPU 38, and the module memory 40, described above. This configuration permits the WSM 124 to communicate with the LCN 120 and the nodes connected thereto. The WSM 124 includes a graphics card 132 coupled to a display 125 and to the PC BUS 131. An Ethernet card 133 permits the WSM 124 to communicate with foreign systems (i.e., systems not coupled to the LCN 120). A microprocessor (mr) 134 of the PC is coupled to the PC BUS 131 and executes the Windows NT Operating System and the Workspace Manager System. A WSM memory 135 is also coupled to the PC BUS 131 and stores the various information (including a configuration file, which will be described later) for use by the mr 134. A keyboard 130 is included for inputting commands to the WSM 124. A mouse interface 136 is provided in the preferred embodiment of the WSM 124.

In order to display a number of windows in an orderly, controlled manner, the display 125 is configured (or mapped) in a predetermined manner. Referring to Figure 5, there is shown an example of a configuration of a display screen (not shown), sometimes referred to as a display surface, of display 125 of WSM 124. The display screen (or workspace) is divided into three categories: schematics, trends, and alarms. This workspace is configured as follows:

- Schematics are limited to the region in which the four initial windows are displayed.
- Trends are positioned along the right side of the workspace in fixed locations.
- Alarms are presented at the bottom of the display.

In the preferred embodiment, the schematic invocation never results in the removal of alarm or trend display and vice versa. In the title area, note that the normal windows functions, such as MIN, MAX, . . . , features are included.

In the microprocessor 134 of WSM 124 there is operating a workspace management program (i.e., software) which in the preferred embodiment is a Windows NT, provided by the Microsoft Corp., which has been modified as will be described hereinunder. In order to achieve the configuration as shown in Figure 5, a window specification file (sometimes referred to as a configuration file) is provided to the workspace management software. The window specification is a set of window properties

replace an existing display (Block 910), the existing display is closed (Block 911) and the program continues to Block 909, in which the display appears in the controlled format and within the controlled, predetermined area, and the program then exits to the wait loop. If an existing display is not to be replaced, the program branches immediately to Block 909. the display appears, and the program exits to Block 902. In the preferred embodiment of the present invention, provision exists for replacing an old display with a newly-requested display. However, it will be understood by those skilled in the art that many variations can be made with the replacement of a display, such as having a priority associated with the display whereby a display of a lower priority cannot replace a display of a higher priority. In addition, displays may be marked by an operator as not being replaceable. . . . It will be understood that many such features and variations thereof exist which are within the scope of the present invention.

If a display is being managed, i.e., operated on or modified (Block 912), the display is checked to determine if the operation is a move, size, stretch, . . . , being requested by the user or the application (Block 913). Before the application visually reflects the results of such an operation, the standard windows operating system (OS) of the WSM software signals its intent to redraw the display with the new coordinates (Block 914). If the display is being managed by the workspace manager, a determination is made whether the new coordinates violate the configuration file (the window specification file) (Block 916). If the coordinates are outside the configuration file, the coordinates are modified to bring them into compliance with the configuration file (Block 915). At Block 914, when the operating system redraws the display with the new coordinates and the display is not being managed by the workspace manager, the display appears in the requested coordinates (Block 917) and the program exits to the wait loop (Block 902). If the new coordinates in Block 916 do not violate the configuration file, the program proceeds to display the requested modified display in the requested coordinates (Block 917), and the program exits to the wait loop (Block 902). After the display modifies the coordinates in Block 915 to bring them into compliance with the configuration file, the display appears in the modified coordinates (Block 918) and the program exits to the wait loop (Block 902).

are "selected" for replacement via special title-bar buttons which are included as part of this invention. The "first match" group is designed to search its list of subgroups and window specifications in a "top-down, depth-first" fashion. All items in this group, including individual window specifications, each have their own match expression. In the preferred embodiment, all three groups of the example of Figure 5 are of the round-robin group type and is so indicated in the window specification file (or sometimes called herein configuration file).

Referring to Figure 7, which comprises Figures 7A and 7B, there is shown a flow diagram of the WSM software operating in the Workspace Manager Display System of the present invention. A display of an application is requested via the keyboard 126 (or via a mouse interface with a corresponding display, not shown). The program operating within the Workspace Manager Display System 124 is essentially waiting for an input (Block 902). Once the input is received via the keyboard (or via the mouse), the message is decoded (Block 903) and branches to point X (Block 900) if a new display window of an application is requested (Block 900), or branches to point Y in Figure 7B if a current display is being operated, on or being manipulated (Block 912). The requested display is created (Block 901) and the operating system creates the window which incorporates the requested display (Block 904). Within the window, any miscellaneous request made by the operator is also set up in the display (Block 905); and if no specific display parameters have been requested, default conditions will be utilized to set up the display (Block 906). If the workspace manager is not involved (i.e., is not to manage the display) or is inoperative or is optionally turned off, the display as requested and as set up appears on the display screen of the display 125 (Block 909), and the program exits to wait state (Block 902). If, however, the workspace manager is to control the display (Block 908), the display is modified in accordance with the workspace manager configuration file (or sometimes referred to herein as the window specification file) (Block 907). The configuration file is stored within the Workspace Manager Display System 124 and is generated offline and contains the parameters which define the workspace area of the display screen. In particular, the location on the display screen is modified such that the requested display appears in the next available window of the Window 1, Window 2, . . . , Trend 1, . . . , or Alarm 1 . . . , in the example of Figure 5. If the requested display is to

It will be recognized by those skilled in the art that the software of the Workspace Manager can be a completely new software package programmed to perform the functions as described in Figure 7. Also, it will be recognized by those skilled in the art that the standard windows operating system (OS) can be utilized and modified in order to incorporate the features of the workspace manager display system as described herein. The window specification file, or configuration file, is a file stored within the WSM memory 135 of the WSM 124. There can be a plurality of configuration files to define various workspace configurations, including a four-window workspace; a five-window workspace, which is similar to a four-window workspace with the fifth workspace having a critical space (or group); a ten-window, three-group workspace, as shown in Figure 5. . . . . Each entry into the configuration file includes the size of the window, the position of the window, ... and/or other characteristics which define the parameters and properties of the window. Although the applications being displayed in the preferred embodiment are process-control related, it will be further understood by those skilled in the art that the application can be any application being monitored, e.g., financial applications when financial systems are being monitored, manufacturing plant operations when utilized in manufacturing operations, ...

The method of the present invention will now be described. Referring to Figure 8, there is shown an example workspace having one (1) critical display positioned at the bottom of the screen and four (4) non-critical displays. Windows 1-4 (schematics), which are positioned in the remainder of the display area. The critical display of Figure 8 is, for example, what has previously been referred to as the Alarm displays. The Workspace Manager program recognizes the different categories of the displays and manages the presentation of these displays according to the category. Thus, important displays, such as Alarm displays, are not covered by those displays deemed less important. The workspace of this example appears on the display surface as shown in Figure 8 upon initial startup. In this example workspace the non-critical displays have been limited to a region in which all four non-critical displays re initially presented. The schematic displays can be moved, sized, and maximized; but these displays are not permitted to extend beyond the window's region. Therefore, the schematic displays never have the opportunity to hide (or overlay)

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display, and indicates an intent to change the display. The Workspace Manager System checks that the "proposed" changes are within the parameters specified by the configuration file. If they are, the proposed changes are passed to output. If not, the proposed changes are modified by the Workspace Manager System to bring the proposed changes within the limits specified by the configuration file.

While there has been shown what is considered the preferred embodiment of the present invention, it will be manifest that many changes and modifications can be made therein without departing from the essential scope and spirit of the invention. It is intended, therefore, in the annexed claims to cover all such changes and modifications that fall within the true scope of the invention.

rxw (x width), and

ryh (h height, of the region, as specified in the configuration file),

if x < rx or

y < ry, then the window is outside the region.

In a similar fashion well known to those skilled in the art, the size is determined to be in/out of compliance, and if not in compliance, modified to bring the display into compliance, e.g. (from above):

x is set to rx, and

y is set to ry.

Modifying the display can be a result of MAX input (which modifies the size), a drag operation assuming a drag is permitted of a window as specified in the configuration file (which modifies the position), a stretch operation (which modifies the size), ... Verifying the coordinates of a modified display to be within a predetermined area, and modifying the coordinates to essentially force a display to be within a predetermined area, are basic techniques and will not be discussed further here.

The configuration file can also define a window to be "always on top". Thus, this feature can be utilized to prevent a critical display from being covered by a non-critical display. For example, as in Figure 8, assuming all windows (Windows 1-4) contained a display, and the display of Window 4 is draggable, but Window 2 is specified as "always on top", if Window 4 is dragged to the middle of the display, as shown in Figure 11, then Window 4 would overlay the displays of Windows 1 and 3, but the display of Window 2 would not be overlain (since it is specified as "always on top").

Above there has been described the windows of the multi-windowed display environment being subject to a region constraint for a predetermined category. Further, each window can be specified in the configuration file as being draggable, being closeable, being sizeable, and having an initial position and size specified. For each of these options, the basic flow is the same as described for region constraint. Namely, the windows operating system responds to the input of dragging, sizing, closing, . . . , generates the new

Claim 4. A method for constraining the available display surface according to Claim 1 further comprising the step of generating the modified application display to overlay other displays of the same category when the configuration file specifies "always on top".

Claim 5. A method for constraining the available display surface according to Claim 1 wherein the input request includes a request to close the application display.

Claim 6. A method for constraining the available display surface according to Claim 1 wherein the input request includes a request to move the application display.

CLAIMS

Claim 1 A method for constraining the available display surface in which an application display is displayed, the display surface being divided into at least a first and a second window whereby each window is defined to occupy a unique area of the display surface, and each window being assigned to a predetermined category of display, the method comprising the steps of:

a) modifying an application display of the first window in response to an input request to modify the display;

b) verifying that the modified application display complies with specified parameters contained in a configuration file, the configuration file including size and position parameters that define the extent that the first window can be modified in order not to alter the display surface occupied by the second window; and

c) if the modified application display does not comply with the specified parameter of the configuration file, altering the modified application display to conform with the parameters of the configuration file; otherwise, proceeding to step d); and

d) outputting the application display.

Claim 2. A method for constraining the available display surface according to Claim 1, wherein the display surface is divided into at least a first and second region for displaying application displays having a first and second category, respectively, and each region having a predetermined number of windows configured within each region, and further wherein an input request to modify an application display modifies the application display within the confines of the region corresponding to the region of the requested application display.

Claim 3. A method for constraining the available display surface according to Claim 1 wherein the input request includes a request to resize the display.

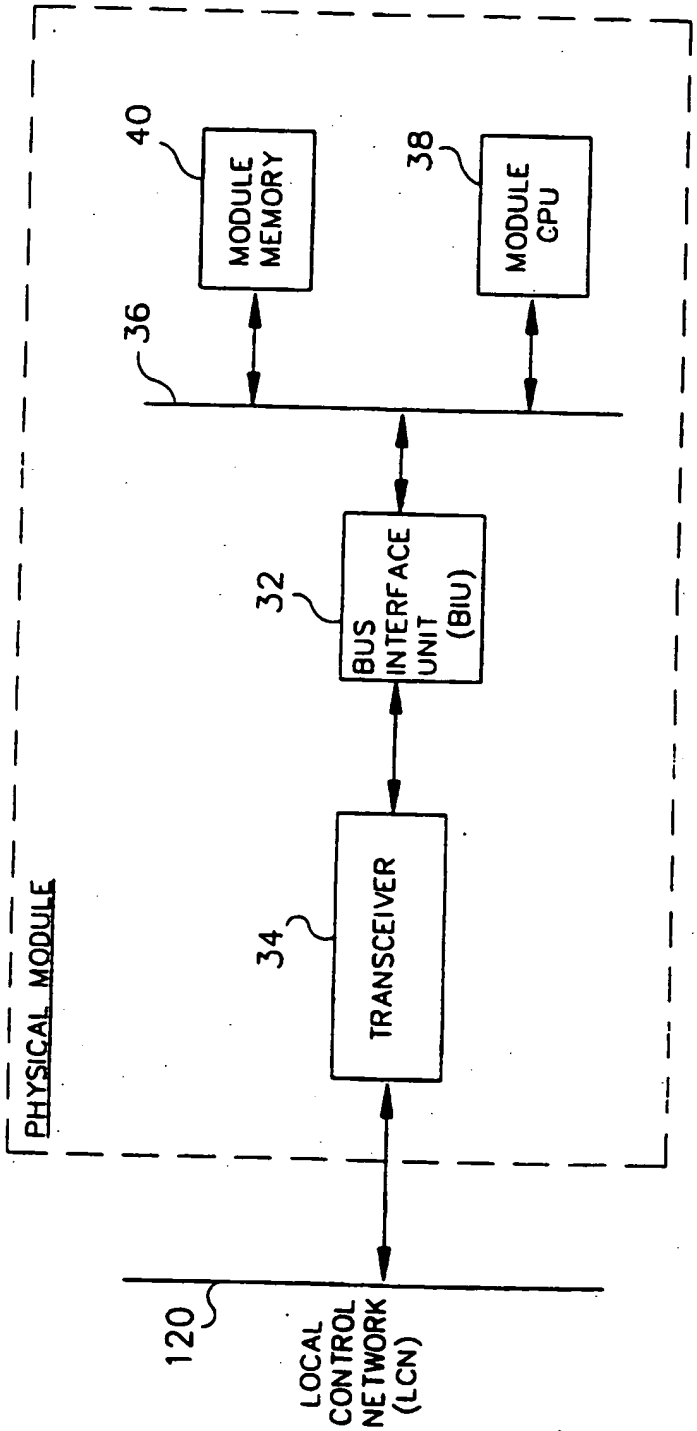

PHYSICAL MODULE
40
MODULE MEMORY
38
MODULE CPU
36
32
BUS INTERFACE UNIT (BIU)
34
TRANSCEIVER
120
LOCAL CONTROL NETWORK (LCN)

Fig. 2

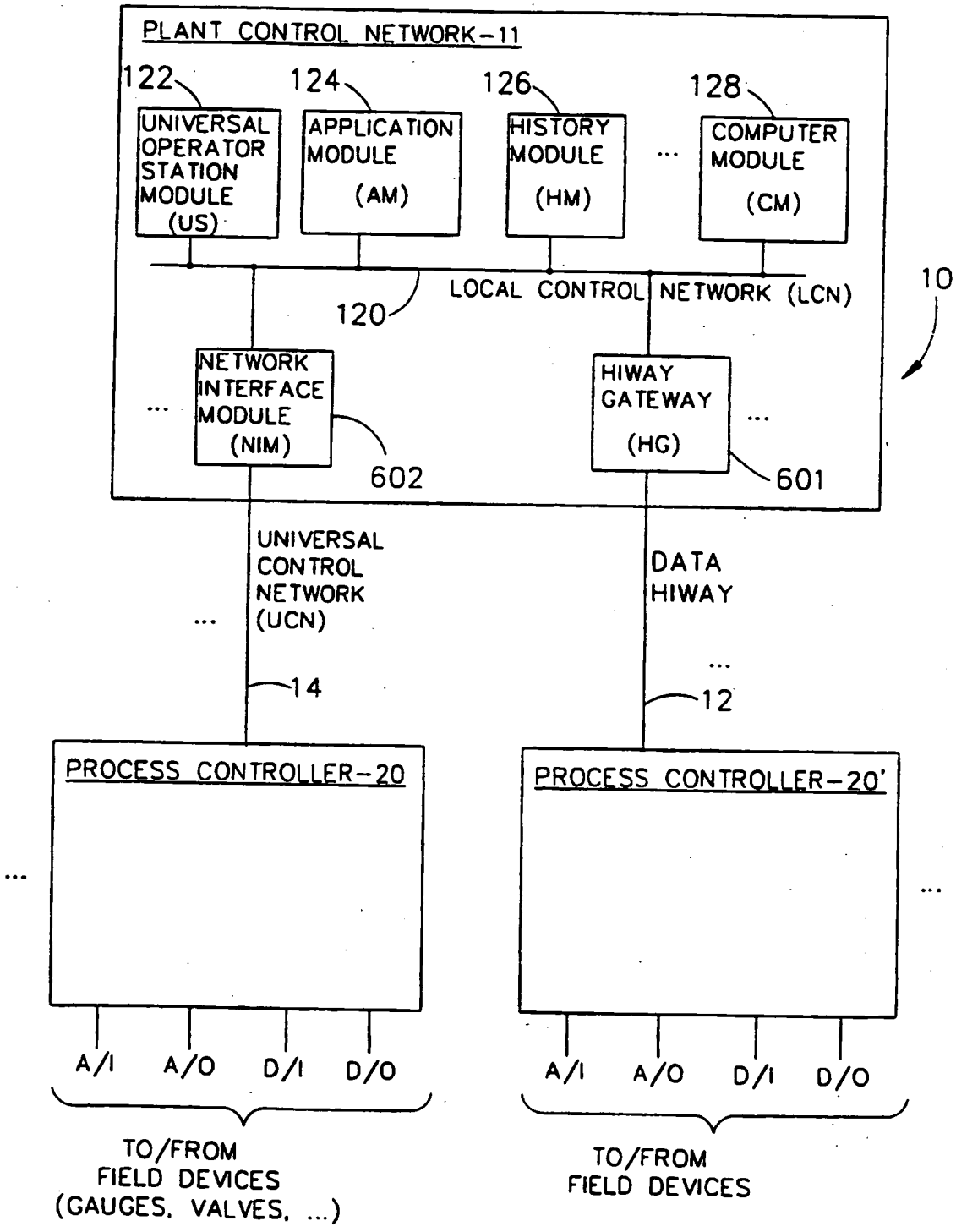

PLANT CONTROL NETWORK-11
122
124
126
128
UNIVERSAL OPERATOR STATION MODULE (US)
APPLICATION MODULE (AM)
HISTORY MODULE (HM)
COMPUTER MODULE (CM)
120
LOCAL CONTROL NETWORK (LCN)
10
NETWORK INTERFACE MODULE (NIM)
602
HIWAY GATEWAY (HG)
601
UNIVERSAL CONTROL NETWORK (UCN)
14
DATA HIWAY
12
PROCESS CONTROLLER-20
PROCESS CONTROLLER-20'
A/I
A/O
D/I
D/O
TO/FROM FIELD DEVICES (GAUGES, VALVES, ...)
TO/FROM FIELD DEVICES

Fig. 1

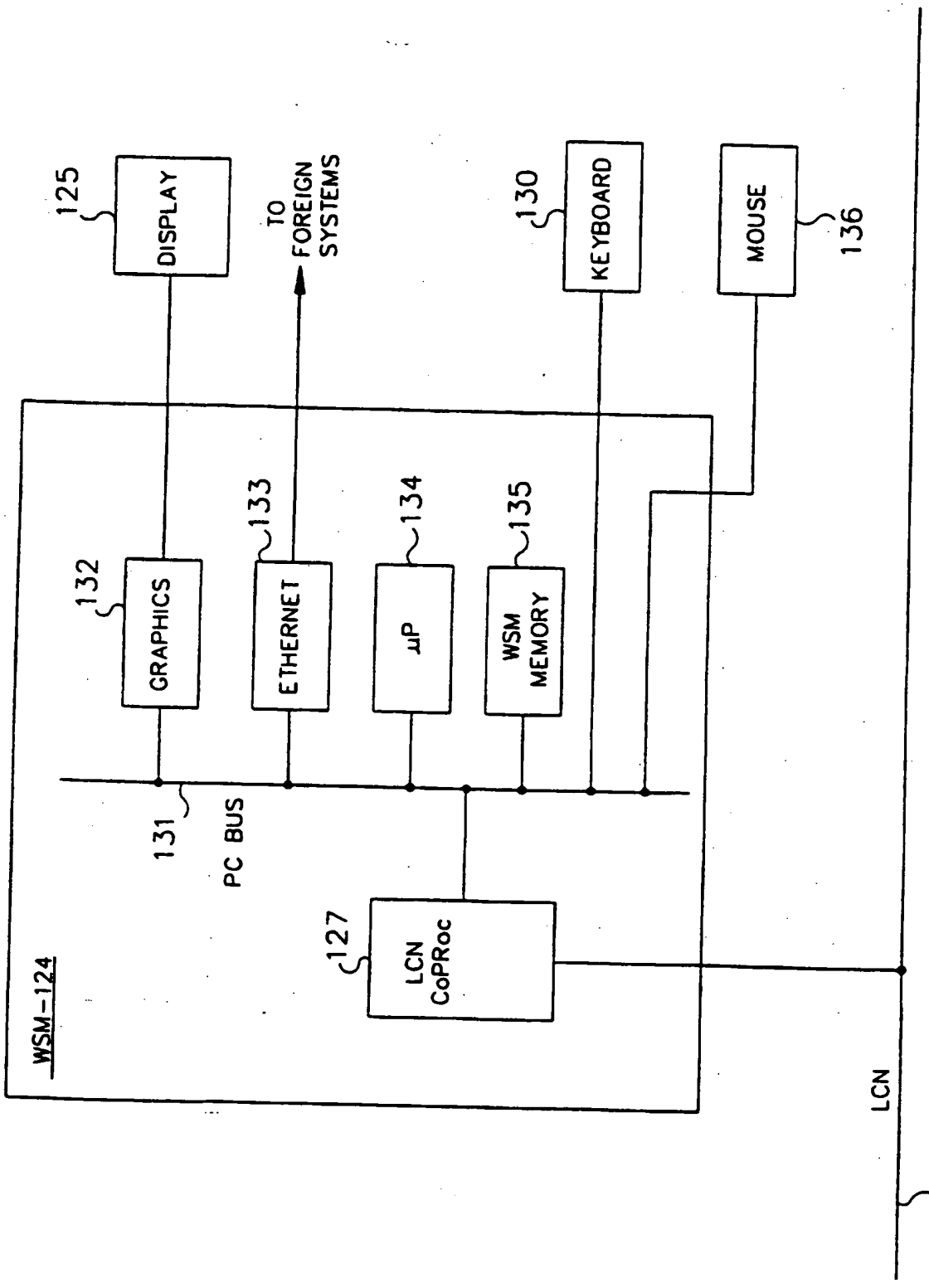

125
DISPLAY
TO FOREIGN SYSTEMS
130
KEYBOARD
MOUSE
136
132
GRAPHICS
133
ETHERNET
134
μP
135
WSM MEMORY
131
PC BUS
127
LCN CoPRoc
WSM-124
LCN
120

Fig. 4

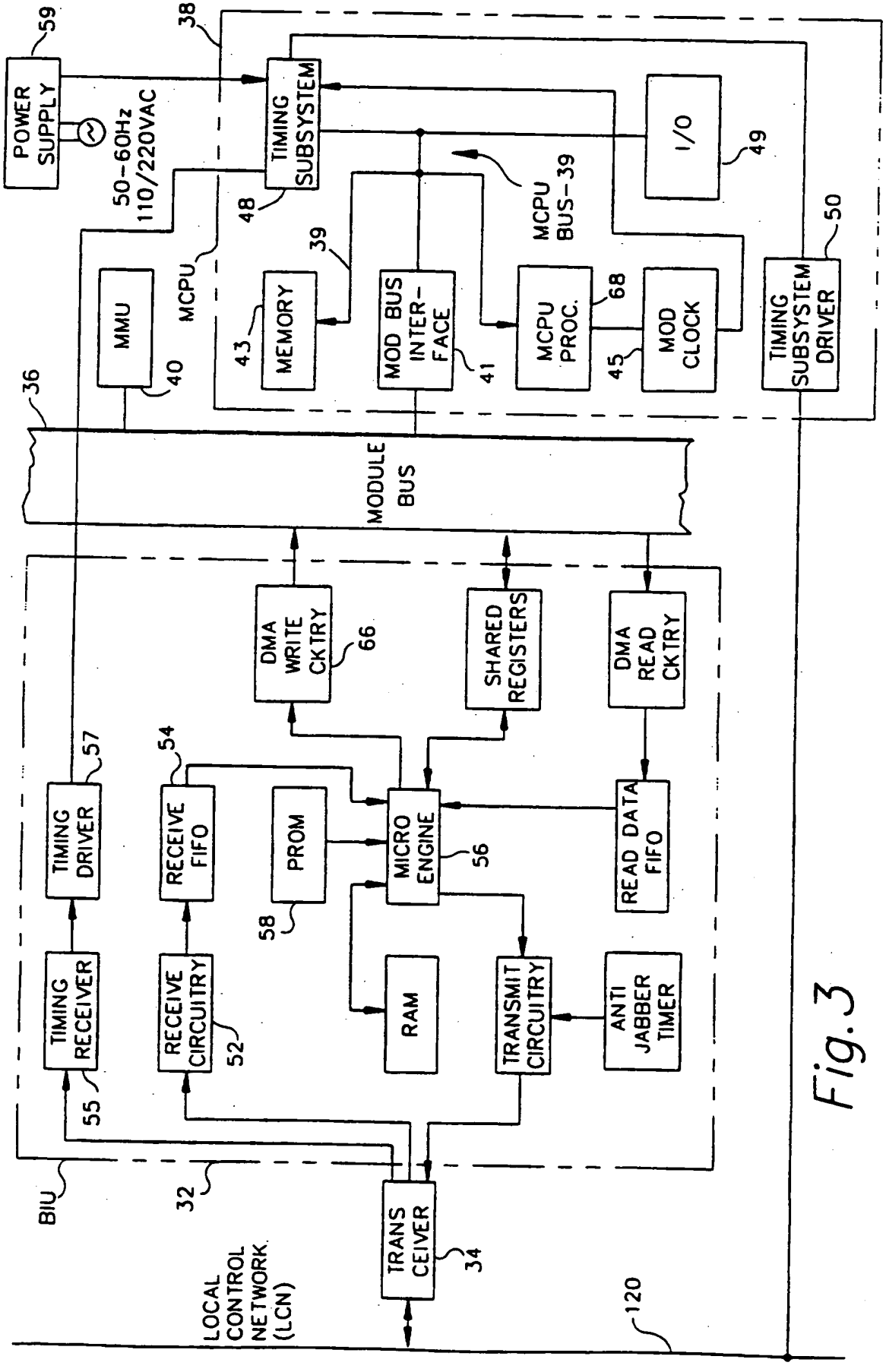

POWER SUPPLY
50-60Hz 110/220VAC
59
38
TIMING SUBSYSTEM
48
I/O
49
MCPU BUS-39
MCPU
MMU
40
39
43
MEMORY
MOD BUS INTER-FACE
41
MCPU PROC.
68
45
MOD CLOCK
TIMING SUBSYSTEM DRIVER
50
36
MODULE BUS
DMA WRITE CKTRY
66
SHARED REGISTERS
DMA READ CKTRY
TIMING DRIVER
57
RECEIVE FIFO
54
PROM
58
MICRO ENGINE
56
READ DATA FIFO
TIMING RECEIVER
55
RECEIVE CIRCUITRY
52
RAM
TRANSMIT CIRCUITRY
ANTI JABBER TIMER
BIU
32
TRANS CEIVER
34
LOCAL CONTROL NETWORK (LCN)
120

Fig. 3

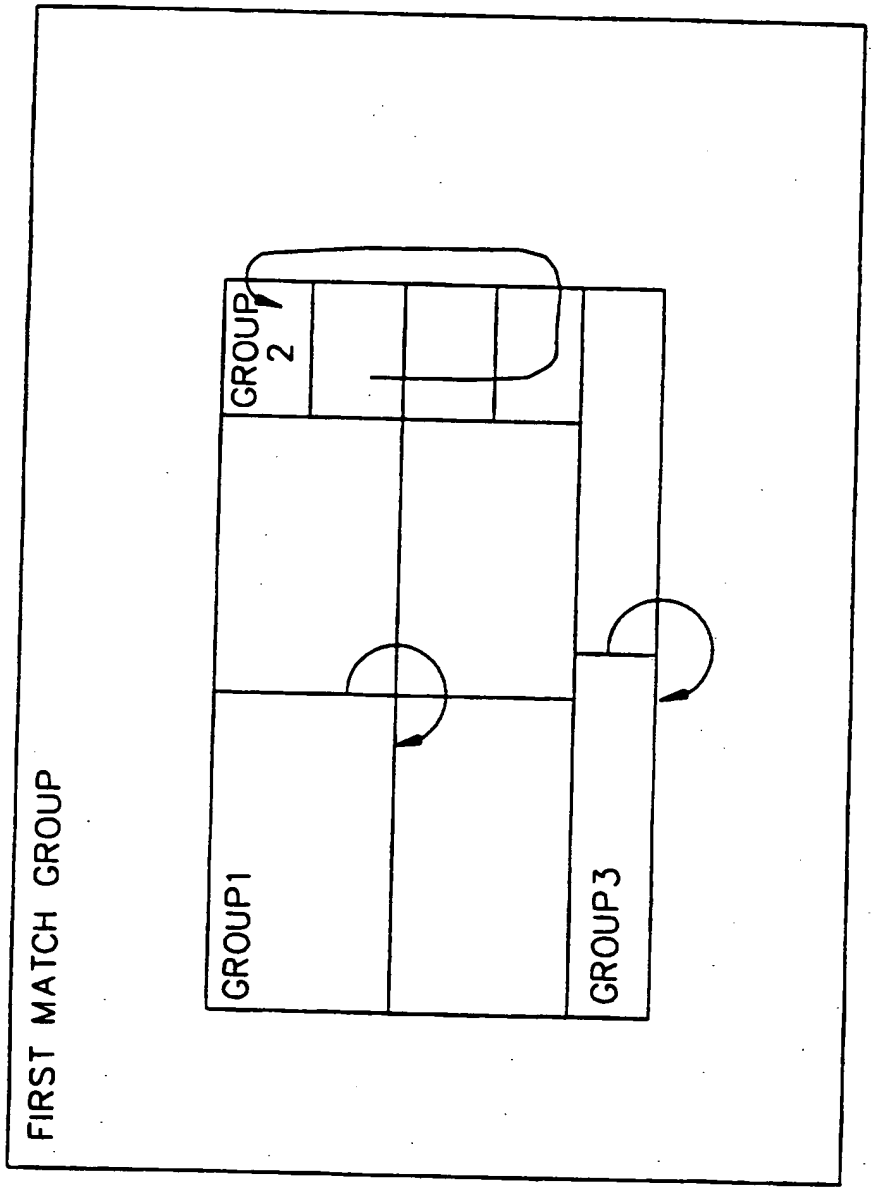


Fig. 6

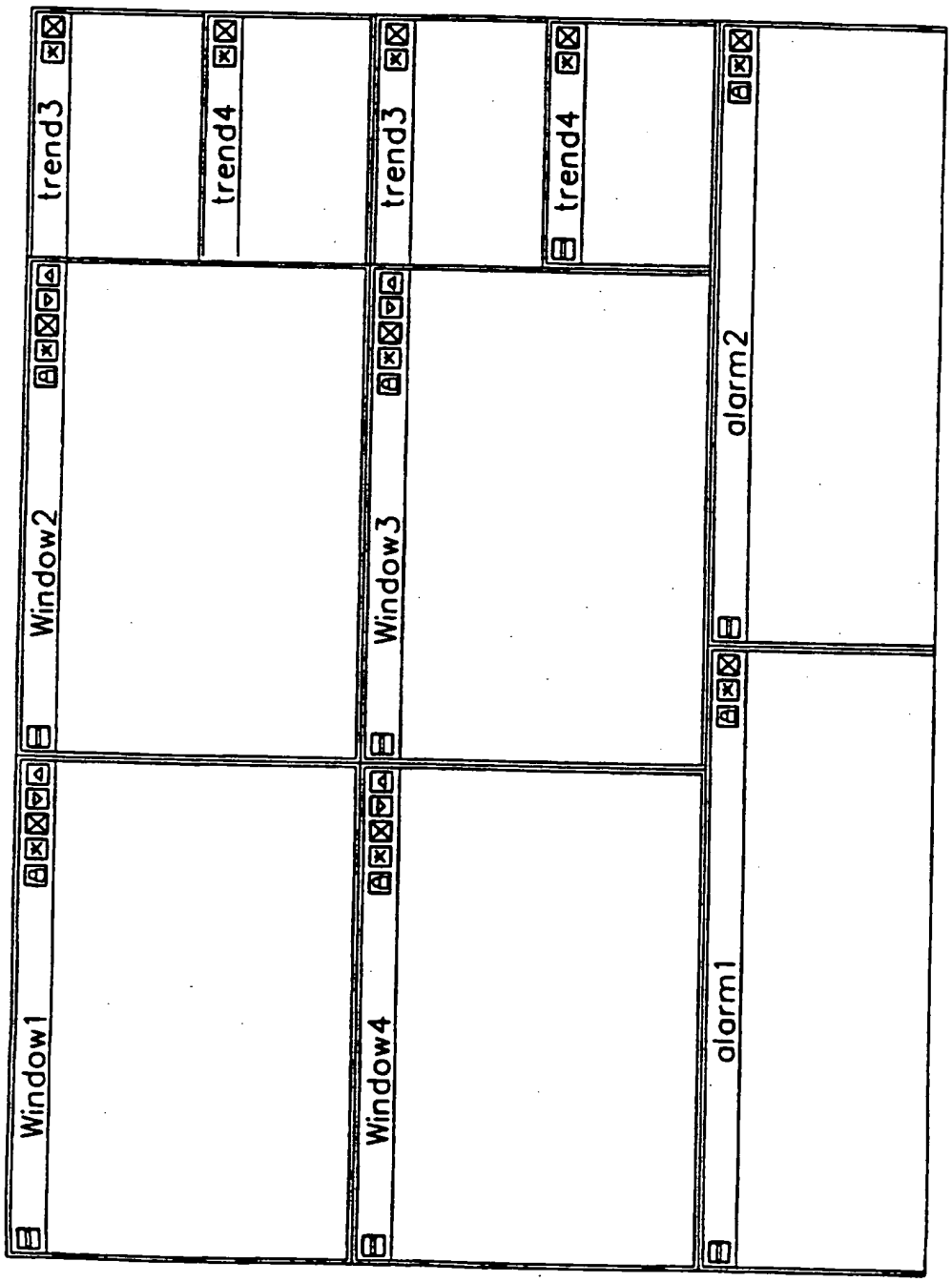

trend3
trend4
trend3
trend4
Window2
Window3
alarm2
Window1
Window4
alarm1

Fig.5

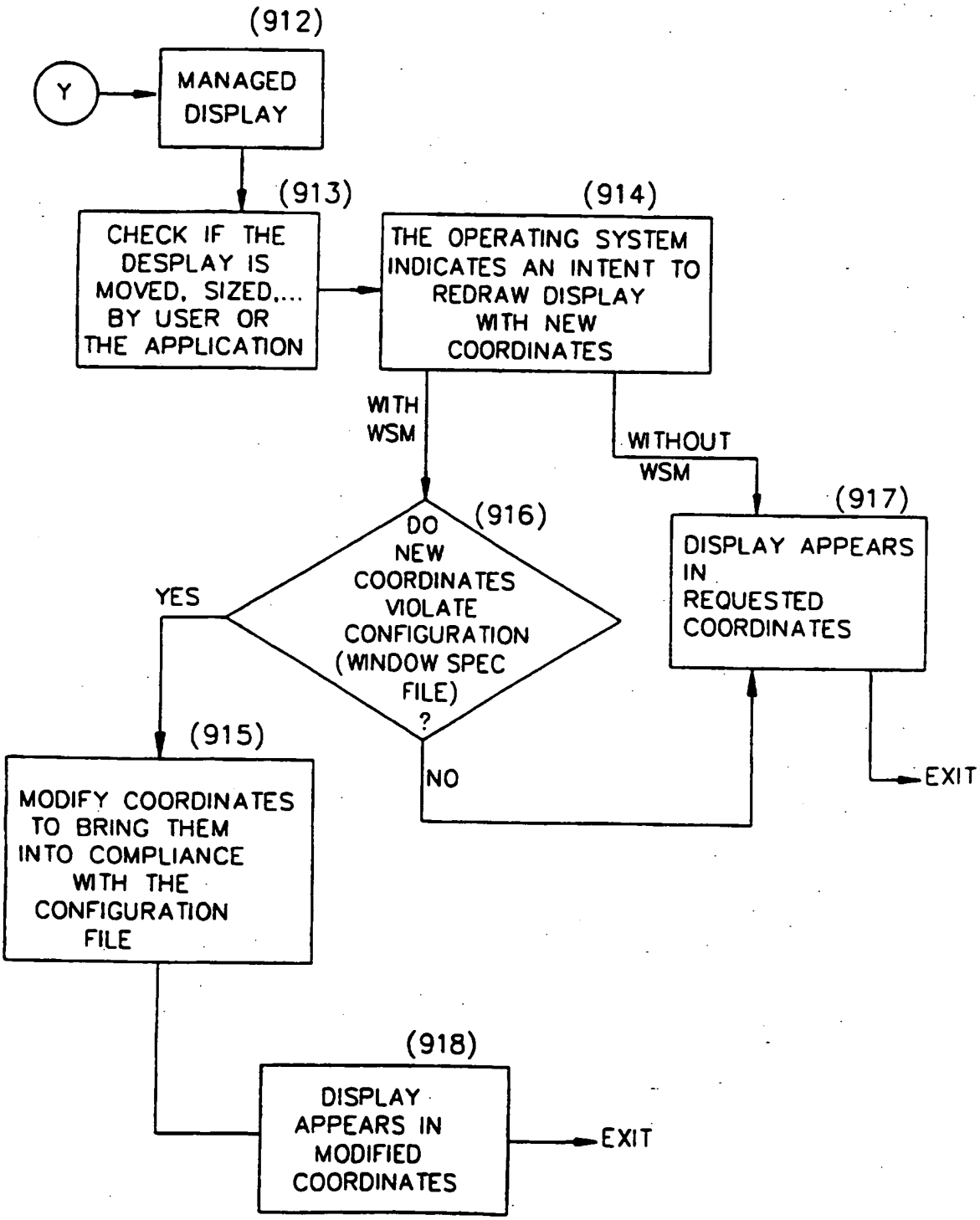

(912)
Y
MANAGED DISPLAY
(913)
CHECK IF THE DESPLAY IS MOVED, SIZED.... BY USER OR THE APPLICATION
(914)
THE OPERATING SYSTEM INDICATES AN INTENT TO REDRAW DISPLAY WITH NEW COORDINATES
WITH WSM
WITHOUT WSM
(916)
DO NEW COORDINATES VIOLATE CONFIGURATION (WINDOW SPEC FILE) ?
YES
NO
(917)
DISPLAY APPEARS IN REQUESTED COORDINATES
EXIT
(915)
MODIFY COORDINATES TO BRING THEM INTO COMPLIANCE WITH THE CONFIGURATION FILE
(918)
DISPLAY APPEARS IN MODIFIED COORDINATES
EXIT

Fig. 7B

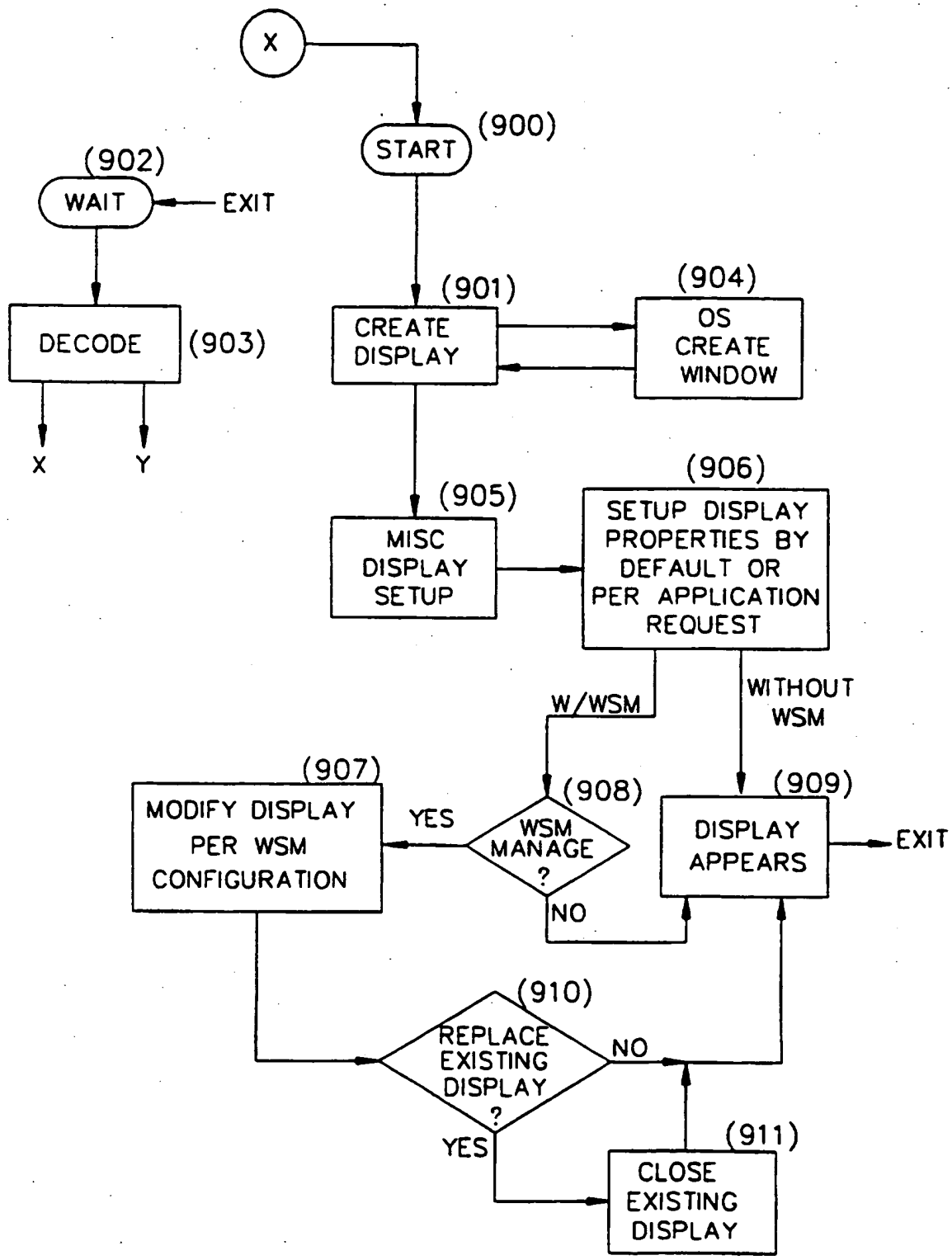

X
START
(900)
(902)
WAIT
EXIT
(901)
CREATE DISPLAY
(904)
OS CREATE WINDOW
DECODE
(903)
X
Y
(905)
MISC DISPLAY SETUP
(906)
SETUP DISPLAY PROPERTIES BY DEFAULT OR PER APPLICATION REQUEST
W/WSM
WITHOUT WSM
(907)
MODIFY DISPLAY PER WSM CONFIGURATION
YES
(908)
WSM MANAGE ?
NO
(909)
DISPLAY APPEARS
EXIT
(910)
REPLACE EXISTING DISPLAY ?
NO
YES
(911)
CLOSE EXISTING DISPLAY

Fig. 7A

Fig. 9

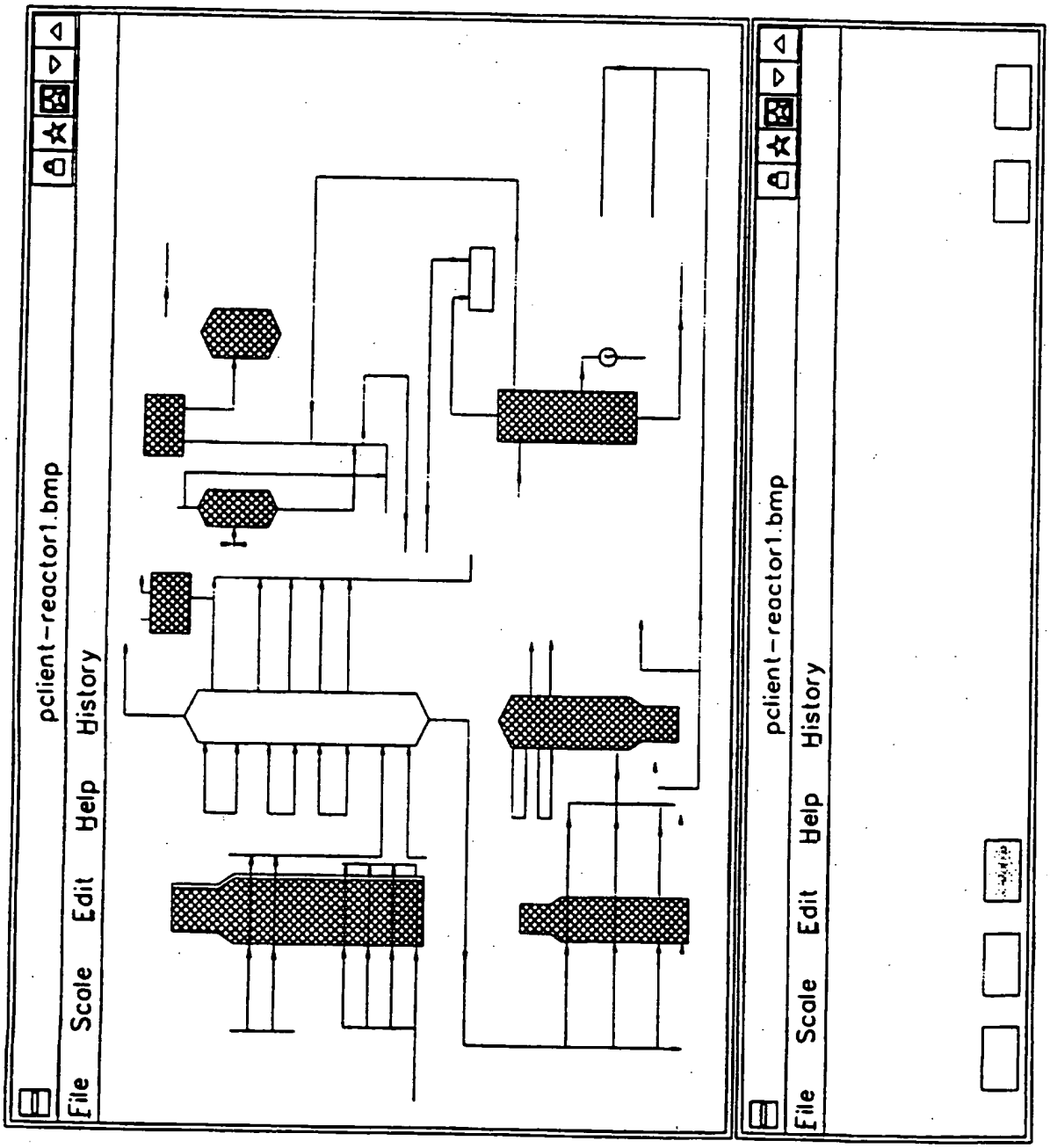
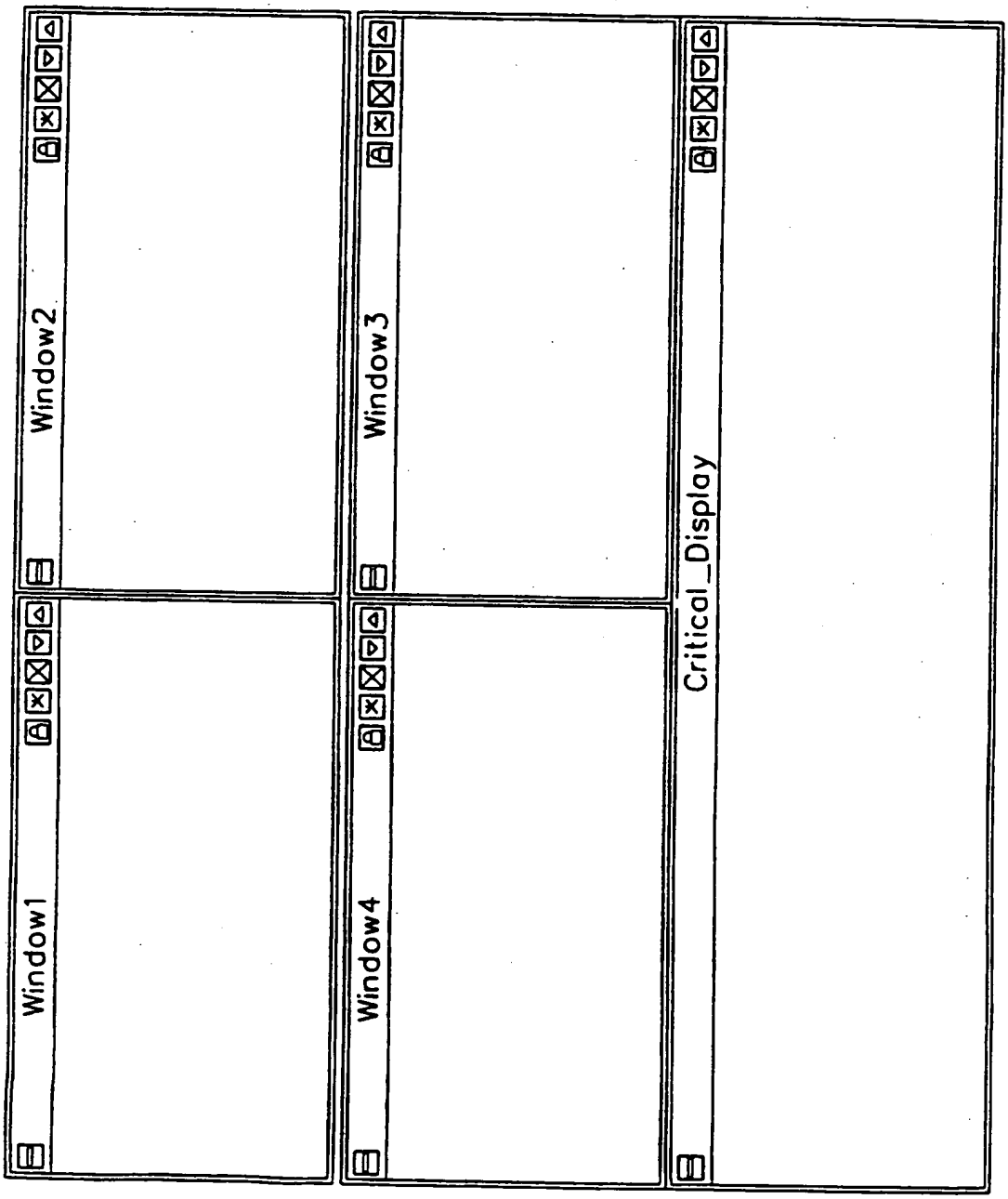

pclient-reactor1.bmp
File Scale Edit Help History
pclient-reactor1.bmp
File Scale Edit Help History

Fig. 8



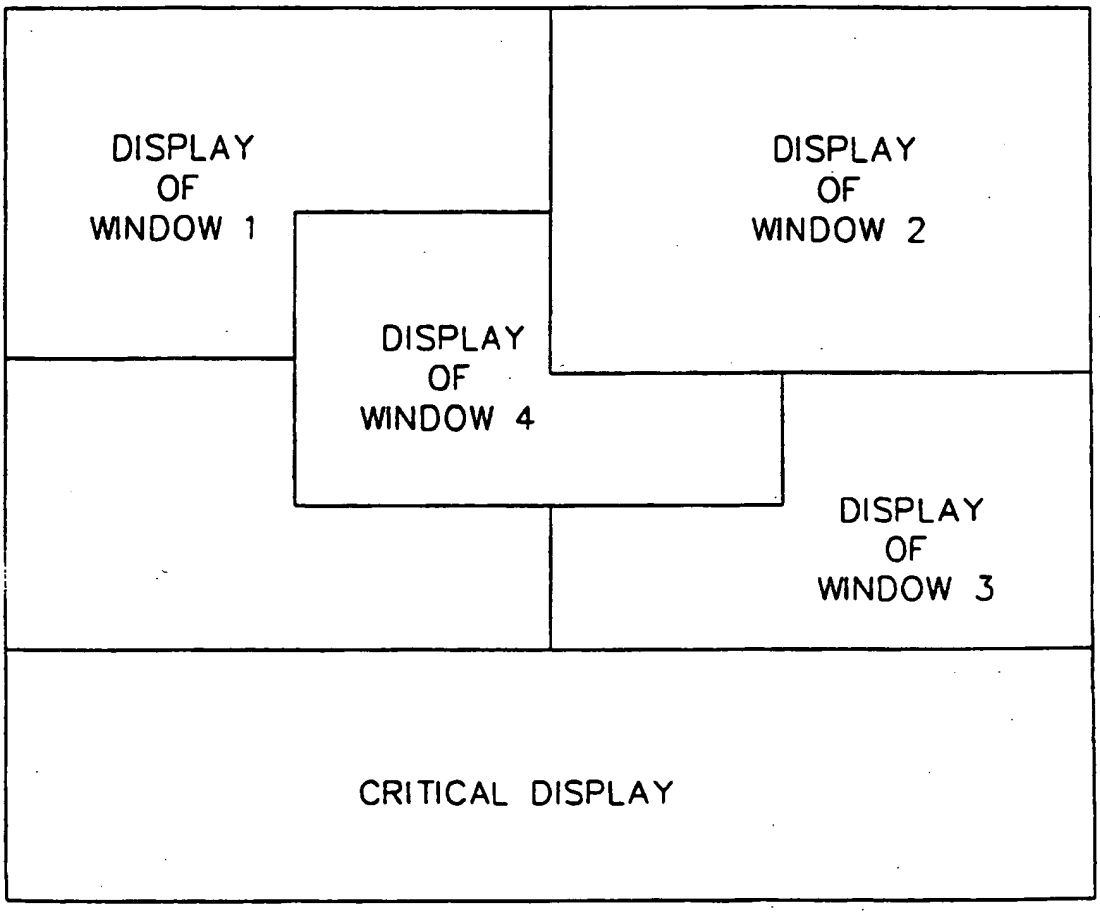

DISPLAY OF WINDOW 1
DISPLAY OF WINDOW 2
DISPLAY OF WINDOW 4
DISPLAY OF WINDOW 3
CRITICAL DISPLAY

Fig. 11

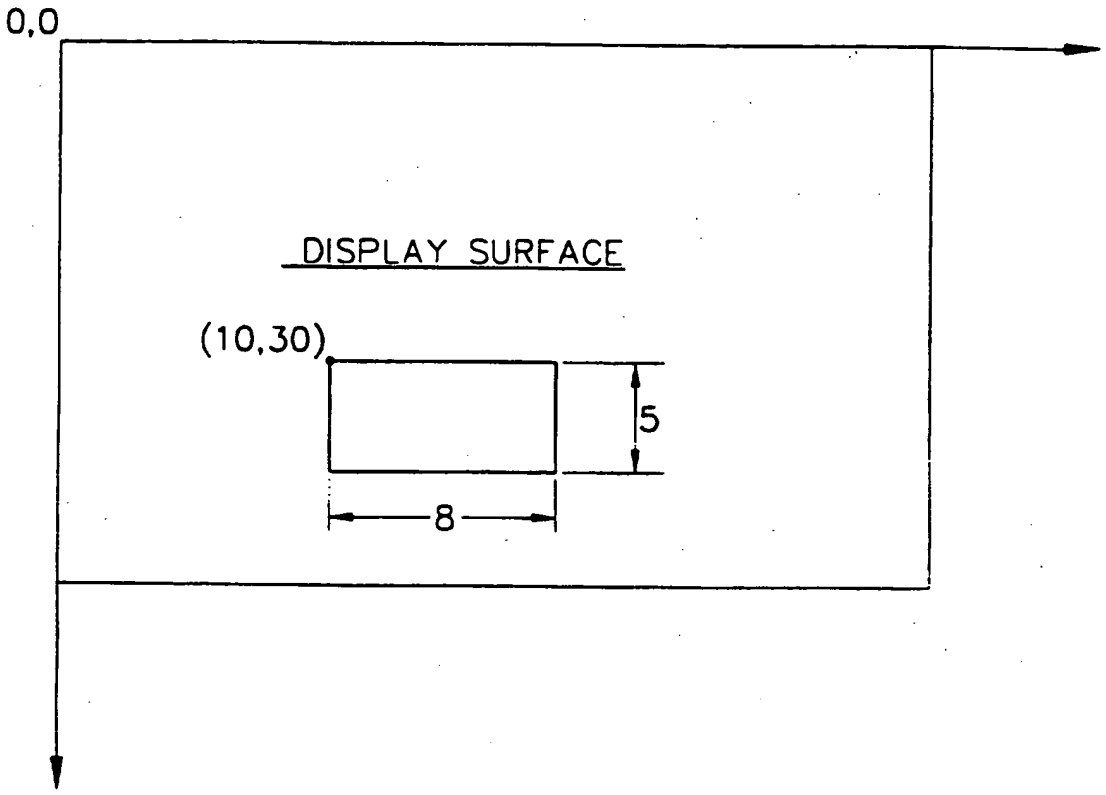


Fig. 10

INTERNATIONAL SEARCH REPORT

Internati ..l Application No
PCT/US 97/16401

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	"USER-FRIENDLY GRAPHICAL INTERFACE FOR WINDOW MANAGEMENT USING REFERENCE FRAMES" IBM TECHNICAL DISCLOSURE BULLETIN, vol. 37, no. 5, 1 May 1994, pages 235-238, XP000453145 see the whole document ---	2
A	PATENT ABSTRACTS OF JAPAN vol. 014, no. 179 (P-1034), 10 April 1990 & JP 02 028716 A (MATSUSHITA ELECTRIC IND CO LTD), 30 January 1990, see abstract -----	1

INTERNATIONAL SEARCH REPORT

Internati ...l Application No
PCT/US 97/16401

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 G06F3/033

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No
X	US 5 487 143 A (SOUTHGATE TIMOTHY J) 23 January 1996 see column 9, line 16 - column 10, line 14 see column 13, line 20 - line 40; claims; figures 8-11 ---	1-6
P,X	EP 0 747 805 A (SONY ELECTRONICS INC) 11 December 1996 see column 3, line 11 - line 26 see column 10, line 2 - line 30; claims 1,6-10,13,22,23,26; figures 6-9,13 ---	1,3-6
A	"ICON SAFE ZONE" IBM TECHNICAL DISCLOSURE BULLETIN, vol. 35, no. 6, 1 November 1992, pages 34-35, XP000314049 see the whole document ---	1-6
	-/--	

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

1

Date of the actual completion of the international search	Date of mailing of the international search report
17 December 1997	30. 01. 98

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Durand, J

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